THE LURE OF MEDICAL HISTORY

MALPIGHI AND LEEUWENHOEK

The Early Microscopists

By WILLIAM DOCK, M. D.
San Francisco

ALTHOUGH magnifying lenses have been found in the ruins of Nimrod's palace at Nineveh, it was not until the seventeenth century that anything like a microscope was used. The inventor's identity is uncertain, but Hans and Zacharias Janssen (1608) and Cornelius Drebbel (1621), all Hollanders, are the earliest proved claimants of this honor. The first microscope was a pair of lenses with a device to hold it at a fixed distance from the object to be examined. These toys were known as "vitra pulicaria," or flea glasses, from the objects most frequently viewed in their day. Modifications of this simple device made possible the biology and medicine of today, for the microscope is incomparably the most important and fruitful instrument which man has built to study himself and his environment.

We know nothing of the microscopes used by Malpighi; they may have been only simple lenses held in the hand, but Leeuwenhoek's twenty-six microscopes, bequeathed to the Royal Society, were arrangements by which a small lens, centered in a silver plate, was held over the object, fixed at a proper distance by a simple set of brass screws and plates. With such rude ships did these pioneers explore a new world, and we are astonished by the thoroughness of their exploration and the accuracy of their reports and charts.

Their lives are of true scholarly simplicity; they lived, saw, wrote and died. Marcellus Malpighi, born in 1628, graduated at Bologna in medicine, with a thesis on Hippocratic medicine (then unpopular because of the rise of iatromathematical and chemical schools). He soon had a chair at Bologna, and here he lived, practiced and studied most of his life. The more remunerative positions at Pisa and at Messina he held for three and four years each, returning because of poor health, and his last three years were spent in Rome as physician to Pope Innocent XII. Tradition makes him a rather unsuccessful practitioner, but the facts seem to have been otherwise. The quiet of his life was somewhat troubled by debates with his early teacher, Borelli, and a family feud with the Sbaraglia. The kind and gentle physician never enjoyed good health and his death at sixty-seven cut short a life of great accomplishments.

Anthony van Leeuwenhoek was neither a university man nor a physician, but a modestly educated son of a well-to-do family in Delft, near Rotterdam. He was well founded in mathematics, and at sixteen was bookkeeper for a clothier in Amsterdam. At twenty-two he married and returned to Delft. He undoubtedly had a comfortable income from the family breweries and perhaps was engaged in trade; for the last thirty-nine of his ninety-one years he was on the town books as chamberlain (in modern parlance janitor) of the council hall, at a yearly salary of $126. This was probably an honorary position with no actual duties involved. We know little of his life and nothing of how he came to microscopy, save that he had industry and curiosity. The 237 microscopes he made attest not only his energy, but a rare degree of mechanical and optical skill. He was honored by his fellow citizens and foreign societies, and was visited by Peter the Great, Czar of All the Russias. He died in 1723, and was buried in the Reformed Church in Delft, where rested the bones of Admiral van Tromp, who had swept the British fleet from the narrow seas.

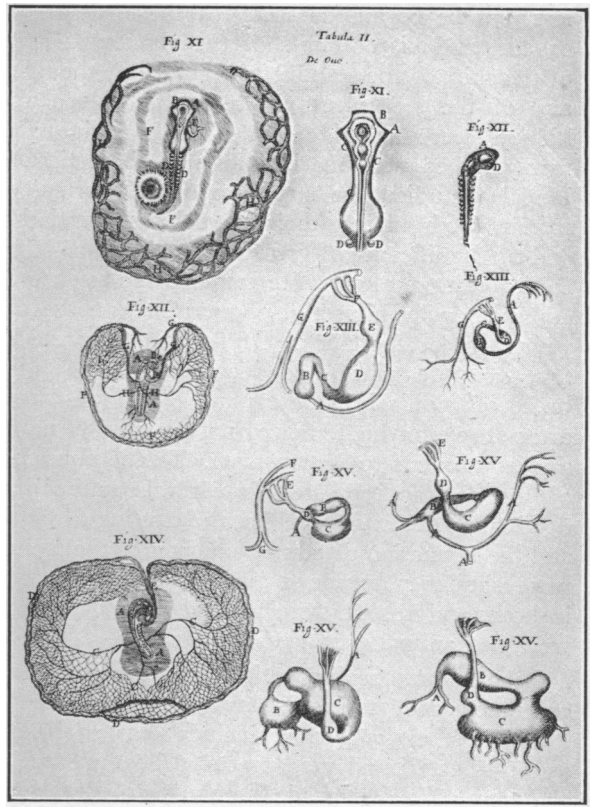

Plate 1.—The development of the chick embryo and its cardiovascular system, an illustration of Malpighi's letter to the Royal Society of London, De Formatione Pulli in Ovo. From the Royal Society edition of the collected works, 1686.

These were quiet unadventurous lives, but the leisure hours of both men were given to such adventures, such novel and exciting worlds as no Magellan or Pizarro ever attained. They crossed the divide which had separated the visible from the invisible, and wandered far and wisely in the vast region thus revealed. Their adventures are recorded in letters to friends and to the young and vigorous Royal Society in England. To this society, Leeuwenhoek sent 375 letters, the first submitted by De Graaf in 1673, seven years before the microscopist's election. Malpighi sent his first paper to the society after being made a member in 1668. More learned than his younger Dutch fellow member, his contributions are less chatty, less speculative; more the accounts of a prospector than of a traveler. His skill in devising experiments and constructing instruments was

less, but he began the study of the structure of organs, and his accounts of the pigmented layer of the skin, of the glandular structure of the liver, and of the structures visible in the spleen and kidney, were accurate and have left his name firmly linked with the histology of these tissues. He also studied the structure of silkworms, of plants (recognizing their sexual differentiation and the significance of growth rings), and of bone, teeth, brain and lung. He founded the science of embryology by his serial observations on the development of the chick. Of final importance, he first saw, described and recognized the significance of capillaries, those minute passages from artery to vein which Harvey postulated, but never seemed anxious to demonstrate. To the physician of the day, unimpressed by all this impractical delving, he demonstrated that the clotting of blood and the formation of plastic exudates in the pleura were similar phenomena and the mural thrombi in heart and vessels were formed from clots, and were not animal parasites or polyps.

Leeuwenhoek's observations, more minute and continued over twice as long a period due to Malpighi's early death, include an enormous sweep—bacteria, plants, insects, fishes, mammals, and man. He also made numerous observations out of the microscopic realm on digestion, perspiration, magnets, calculi, and the like. The alkaloids in tea, the insects of the cochineal, then an important dye, the striations in muscle, the layers of the gut were first seen by him. He studied sheep flukes, and spermatozoa from every animal he could, including bees and whales. They had been seen before, but he recognized their true character and importance in generation. He studied the animalculae of the furred tongue and the squamous cells of the skin, but took particular delight in the rich bacterial flora of the gums and teeth.

He was not the first to see the corpuscles of blood, but he first succeeded in seeing the blood stream, dividing into more and more minute vessels until it reached capillaries admitting only corpuscles in single file, complete the trip from artery to vein. This was seen in the tadpole's tail; in seeking this goal he had tried the cock's comb and gills, the rabbit's ear and the bat's wing. Having succeeded he made many observations, particularly on eels' tails, and saw the blood corpuscles change color in the capillaries, was astonished by the vascular reactions to bruise and to vessel obstruction, and finally saw anastomoses open up around the occluded vessel.

The Royal Society published the collected works of both of these microscopists during their lifetime and it is a pleasant lesson in the unity of science that the shrewd and busy Englishmen so quickly appreciated the value of these observations. We can imagine the delightful meetings at

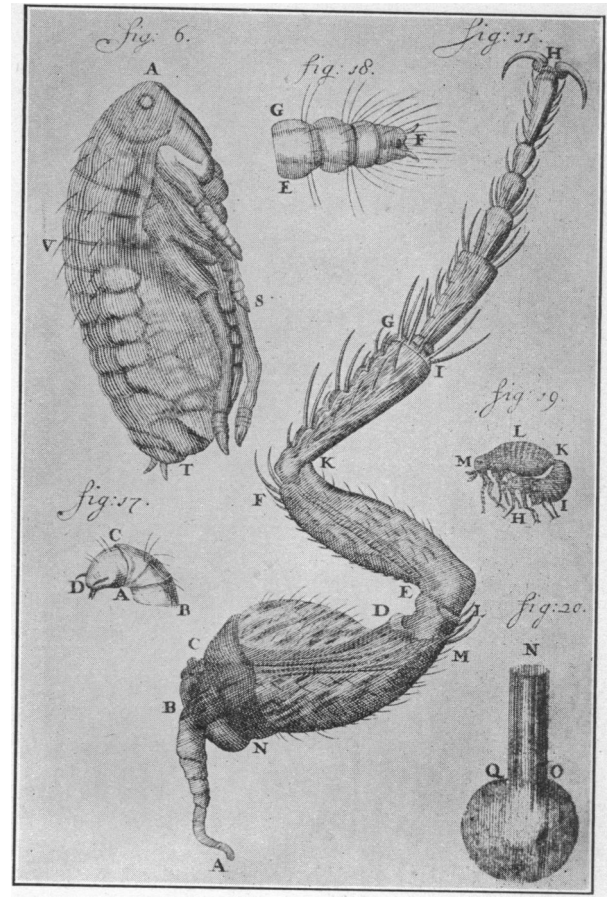

Plate 2.—The flea's leg, as seen by Leeuwenhoek. This is part of a plate of excellent drawings, illustrating the finer anatomy of the flea and its development from the egg through larval stage to adult form. Fig. 6 is the pupa of the flea; 17 and 18 are details of the larval structure; 19, of the fertilization of the female flea, M. L. K. From the Letters to the Royal Society in London, Dutch Edition, Volume IV, Delft, 1694.

which were read the cautious reports of the Italian and the naïve and enthusiastic observations of the Hollander. What could have been more human than his account of the flea's leg? He records that when he, who had been only moderately surprised by his many strange discoveries, looked first at this curious structure, there burst from his mouth the words, "Good God, what are all the marvels in such a small creature!"

Stanford University School of Medicine.

The Physician.—There are men and classes of men that stand above the common herd: the soldier, the sailor, and the shepherd not infrequently; the artist rarely; rarelier still, the clergyman; the physician almost as a rule. He is the flower (such as it is) of our civilization; and when that stage of man is done with, and only remembered to be marveled at in history, he will be thought to have shared as little as any in the defects of the period, and most notably exhibited the virtues of the race. Generosity he has, such as is possible to those who practice an art, never to those who drive a trade; discretion, tested by a hundred secrets; tact, tried in a thousand embarrassments; and what are more important, Herculean cheerfulness and courage. So it is that he brings air and cheer into the sickroom, and often enough, though not so often as he wishes, brings healing.—*From the Dedication of the "Underwoods"—Robert Louis Stevenson.*